PATENT CLAIMS

What is claimed is:

1. A method for determination of the angular position (θ) of a rotor (2), which has a number of pole pairs, of an electric motor (1), having the following steps:
   - Current is passed through at least one stator winding (7) of the electric motor (1) with a pulse pattern (PM1, PM2, PM3) and a pulse duration (T) such that the rotor (2) rotates through not more than 90° divided by the number of pole pairs during the pulse duration (T),
   - The angular acceleration (α) of the rotor (2) produced by the current that is passed through the at least one stator winding (7) is recorded,
   - The angular position (θ) of the rotor (2) is determined by means of the relationship between the current that is passed through the stator winding (7) and the angular acceleration (α) of the rotor (2).

2. The method as claimed in claim 1,
   characterized in that the angular acceleration (α) of the rotor (2) is measured by production of a measurement variable which is physically dependent on the angular acceleration (α), without incremental position determination and without speed measurement.

3. The method as claimed in claim 1 or 2, characterized in that the current is passed through the stator windings (7) by means of components (i_x, i_y) which are linearly independent of one another and each have a current-flow pattern (BM_{1x}, BM_{1y}, BM_{2x}, BM_{2y}, BM_{3x}, BM_{3y}).

4. The method as claimed in one of claims 1 to 3, characterized in that the rotor (2) rotates through no more than 2° during the pulse duration (T).

5. The method as claimed in one of claims 1 to 4, characterized in that the rotor (2) is stationary at the start of the determination of its angular position (θ).

6. The method as claimed in one of claims 1 to 4, characterized in that the rotor (2) is already rotating at the start of the determination of its angular position (θ).

7. The method as claimed in one of claims 3 to 6, characterized in that the components (i_x, i_y) of the pulse pattern (PM1, PM2, PM3) have current-flow patterns (BM_{1x}, BM_{1y}, BM_{2x}, BM_{2y}, BM_{3x}, BM_{3y}) which are offset in time within the pulse duration (T).

8. The method as claimed in claim 7, characterized in that the current is passed through the stator windings (7) by means of a two mutually orthogonal components (i_x, i_y).

9. The method as claimed in claim 7 or 8, characterized in that the current-flow patterns (BM_{1x}, BM_{1y}, BM_{2x}, BM_{2y}, BM_{3x}, BM_{3y}) of the various components (i_x, i_y) are identical.

10. The method as claimed in one of claims 7 to 9, characterized in that a current-flow patterns (BM_{1x}, BM_{1y}, BM_{2x}, BM_{2y}, BM_{3x}, BM_{3y}) has a current-flow phase within which the component (i_x, i_y) is not zero, as well as a phase with no current flow.

11. The method as claimed in claim 10 characterized in that a current-flow phase of one of the components (i_x, i_y) of the pulse pattern (PM1, PM2, PM3) is located within a phase in which no current flows of another component (i_y, i_x) of the same pulse pattern (PM1, PM2, PM3).

12. The method as claimed in one of claims 3 to 6, characterized in that the two components (i_x, i_y) of the pulse pattern (pm1, pm2, pm3) are synchronous, but have different current-flow patterns (BM_{1x}, BM_{1y}, BM_{2x}, BM_{2y}, BM_{3x}, BM_{3y}).

13. The method as claimed in one of claims 3 to 12, characterized in that a current-flow pattern (BM_{1x}, BM_{1y}, BM_{2x}, BM_{2y}, BM_{3x}, BM_{3y}) has sections in which the components (i_x, i_y) have different mathematical signs, such that this does not result in any permanent change in the angular position (θ) of the rotor (2).

14. The method as claimed in claim 13, characterized in that in each case one edge section in which the component (i_x, i_y) has the opposite mathematical sign occurs within a current-flow pattern (BM_{1x}, BM_{1y}, BM_{2x}, BM_{2y}, BM_{3x}, BM_{3y}) at a time before and after a central section in which the component (i_x, i_y) has a first mathematical sign.

15. The method as claimed in claim 14, characterized in that the magnitude of the maximum current ($+I_{x0}$, $+I_{y0}$) of the component (i_x, i_y) in the central section corresponds to the magnitude of the maximum current in the edge section.

16. The method as claimed in claim 15, characterized in that the edge sections each have the same time duration (T_1), and this duration is in each case half the duration ($2\ T_1$) of the central section.

17. The method as claimed in one of claims 1 to 16, characterized in that the pulse pattern (PM1, PM2 PM3) is repeated periodically.

18. The method as claimed in one of claims 1 to 17, characterized in that the pulse pattern (PM1, PM2, PM3) comprises a square-wave pulse.

19. The method as claimed in one of claims 1 to 17, characterized in that the pulse pattern (PM1, PM2, PM3) has a sinusoidal current profile.

20. An apparatus for determination of the angular position of a rotor (2), which has a number of pole pairs, of an electric motor (1), having
    - stator windings (7) which are intended to have a pulse pattern (PM1, PM2, PM3) of a pulse duration (T) applied to them,
    - an acceleration sensor (6), which is intended to record the angular acceleration (α) of the rotor (2) caused by the current passing through the stator windings (7),
    - an evaluation unit (8), which interacts with the stator windings (7) and with the acceleration sensor (6),

    in order to carry out a method as claimed in one of the claims up to 18.

21. The apparatus as claimed in claim 19, characterized in that a Ferraris sensor is provided as the acceleration sensor (6).

22. The apparatus as claimed in claim 19 or 20, characterized in that the rotor (2) is in the form of a permanent-magnet rotor.